throw light upon the questions of what crop plants make most economical use of water and of what wild plants are best suited to their desert and semi-desert habitats. A former review[24] has called attention to the investigation of these problems by SHANTZ and BRIGGS during 1910 and 1911, while a more recent paper reports the results of the same investigators[25] obtained during the summers of 1912 and 1913. The investigations are remarkable for the extensive scale upon which they have been conducted, and for their duration throughout the growing season. More than 50 species have been the subjects of study, and for some the period of investigation extends over three years and includes many individual plants grown from seedling to maturity, the final result being the average of many determinations. As a rule, the same variety gave consistent results, although considerable differences were found between different varieties of the same plant; for example, the variety of alfalfa having the highest water requirement was nearly 50 per cent above the lowest.

Millet has proved throughout an excellent dry land crop, producing a unit of dry weight for every 310 units of water absorbed. It is closely followed by sorghum with a water requirement of 322, corn with 368, and sugar beet with 397; then come wheat with 513, barley with 534, oats with 597, alfalfa with 831, and others that it is impossible to enumerate here. Weeds show the greatest known range from such economic forms, as *Amaranthus* with 292, *Salsola pestifer* with 336, *Bouteloua gracilis* with 389, through such intermediate forms as *Xanthium commune* with 432, *Grindelia squarrosa* with 608, and *Helianthus petiolaris* with 683, up to *Ambrosia artemisiaefolia* with 948 and *Agropyron Smithii* with 1076. Like previous investigations by the same workers, this report contains a vast amount of exact quantitative data of value in studying the agricultural possibilities and the ecology of the great plains.—GEO. D. FULLER.

The origin and relationships of the Indonesian flora.—It is well known that WALLACE, basing his conclusions chiefly on animals, held to the idea of a sharp boundary line in the Straits of Macassar, separating the Indo-Malay and Australasian biogeographic regions. Not only were Borneo and Celebes thus separated biogeographically, but the line was supposed to separate such closely adjoining islands as Bali and Lombok, east of Java. Botanists generally have not found sharp lines between the Malay and Australian floras. HALLIER,[26] working under excellent auspices, finds that Asiatic types extend

[24] BOT. GAZ. 56:514–515. 1913.

[25] BRIGGS, L. J., and SHANTZ, H. L., Relative water requirement of plants. Jour. Agric. Research 3:1–63. *pls.* 7. 1914.

[26] HALLIER, HANS, Die Zusammensetzung und Herkunft der Pflanzendecke Indonesiens. Separate reprint from J. ELBERT's Die Sunda-Expedition des Vereins für Geographie und Statistik zu Frankfurt am Main 2:275–302. *figs.* 2. 1912.

far into Polynesia, fading out gradually instead of stopping abruptly. Similarly the Polynesian types extend into Indonesia, ceasing gradually and not suddenly. Thus phytogeographers are given more solid reasons than ever for opposing the view of WALLACE. Starting from this sure foundation, HALLIER sets out on the perilous task of constructing land bridges between present-day islands and continents. He believes that Indonesia, Australia, and Polynesia were once connected, the islands now existing having been the mountain peaks of this former continent. In still older times HALLIER believes that Australasia and Polynesia were connected by a wide land bridge with America, the northern boundary extending through the Sandwich Islands to Lower California and the southern boundary extending from the southern islands of New Zealand, south of the Society Islands, through Easter Island and Juan Fernandez to southern Chile. HALLIER'S views recall the submerged continent postulated by DARWIN in connection with his theory of the origin of coral islands; nowadays, however, geologists seem to be getting more and more convinced of the relative permanency of oceans and continents, at least throughout the more recent ages. The possibilities of plant migration in our present world are so very large that botanists may well leave to the zoologists the construction of extensive land bridges and the arbitrary submergence and emergence of continents.—H. C. COWLES.

Evaporation and plant succession.—Among the recent contributions of quantitative data concerning the factors causing the succession of plant associations is a study by WEAVER[27] of the evaporation conditions within certain grassland and forest associations of Washington and Idaho. The succession is from the prairie to a climax forest of cedar (*Thuja plicata*), and the record extends over 126 days beginning May 7, 1912. The average daily amounts of evaporation for the various associations taken in the order of their occurrence in the succession are, approximately, bunch grass 28 cc., prairie with southwest exposures 23 cc., prairie with northeast exposure 17 cc., yellow pine (*Pinus ponderosa*) 12 cc., fir-tamarack 9 cc., and cedar forest 8 cc. These atmospheric conditions are further compared, and using those of the mesophytic cedar forest as the standard of reference, it is found that "in the fir-tamarack association from May to September, atmospheric conditions in the lower stratum are 120 per cent as severe, in the average prairie of the plains 250 per cent, and in the bunch grass association 345 per cent as unfavorable for plant life as regards the evaporating power of the air." Moreover, the conditions in the mesophytic forest are found to be almost identical to those recorded by the reviewer[28] for the climax mesophytic forest of the eastern United States as determined in

[27] WEAVER, J. E., Evaporation and plant succession in southeastern Washington and adjacent Idaho. Plant World **17**:273–294. 1914.

[28] FULLER, G. D., Evaporation and plant succession. BOT. GAZ. **52**:193–208. 1911.